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Supplemental Work Plan for Tc-99 Evaluation in Groundwater, Waste Area Group 3, Group 4, Perched Water

Idaho Completion Project

Bechtel BWXT Idaho, LLC

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Idaho Completion Project
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
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ABSTRACT

This Work Plan has been prepared for the preliminary evaluation of elevated Tc-99 activity observed in the Snake River Plain Aquifer monitoring well ICPP-MON-A-230 at the Idaho Nuclear Technology and Engineering Center. The objectives of this Work Plan are to (1) determine if the observed Tc-99 activity is the result of borehole cross-contamination or transport of contaminants from the near surface and (2) evaluate potential sources of near-surface contamination that could be responsible for the elevated Tc-99 activity. The Work Plan has been prepared as a supplement to existing Waste Area Group 3, Operable Unit 3-13, Group 4, Perched Water, monitoring documents as prescribed for the evaluation of a significant unanticipated condition. This Work Plan describes the additional soil and groundwater sampling, well development and pump testing, and other data evaluation tasks necessary to perform the preliminary study. These activities will be performed in an expedited manner so that the information can be incorporated in a revision of the Waste Area Group 3, Operable Unit 3-14 Remedial Investigation/Feasibility Study Work Plan.

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ACRONYMS

BBWI	Bechtel BWXT Idaho, LLC
EPA	Environmental Protection Agency
HASP	health and safety plan
HLLW	high-level liquid waste
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
MCL	maximum contaminant level
OSHA	Occupational Safety and Health Administration
OU	operable unit
RI/BRA	remedial investigation/baseline risk assessment
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SBW	sodium-bearing waste
SDWA	Safe Drinking Water Act
SNF	spent nuclear fuel
SRPA	Snake River Plain Aquifer
Tc-99	Technetium-99
USGS	United States Geological Survey
WAG	waste area group

Supplemental Work Plan for Tc-99 Evaluation in Groundwater, Waste Area Group 3 Group 4 Perched Water

1. INTRODUCTION

Waste Area Group (WAG) 3, Operable Unit (OU) 3-13, has identified the need to perform additional evaluation of elevated activity of technetium-99 (Tc-99) in the tank farm aquifer well (ICPP-MON-A-230; also known as TF-Aquifer). Results of sampling performed in this well in May and August 2003 identified that the Tc-99 activity exceeds the maximum contaminant level (MCL) and groundwater quality standard for Tc-99. This well was installed as part of the WAG 3, Group 4, perched water monitoring activities and the first sampling of this well occurred in May 2003. In light of this exceedence, additional activities have been identified to assess the contamination in this well. These activities will be performed in an expedited manner so that the information can be incorporated in a revision to the WAG 3, OU 3-14, Remedial Investigation/Feasibility Study (RI/FS) Work Plan.

1.1 Background

Tc-99 is long-lived radionuclide that is present as a fission product or activation product in spent nuclear fuel (SNF). Therefore, SNF reprocessing facilities are considered potential sources of Tc-99 to the environment. As a result of its long half-life (≈212,000 years) and relatively high subsurface mobility (similar to tritium or I-129), releases of Tc-99 to the environment must be kept to a minimum. The drinking water MCL for Tc-99 is 900 pCi/L, which is based on a derived concentration assuming Tc-99 is the only beta-emitting radionuclide present (EPA 2000). While drinking water standards do not technically apply to groundwater in the aquifer, the State of Idaho has adopted groundwater quality standards that are numerically equivalent to the Environmental Protection Agency (EPA) MCLs (IDAPA 58.01.11).

Groundwater samples collected at INEEL in 1991-92 by the U.S. Geological Survey (USGS) were the first to be analyzed for Tc-99, and the results are reported in Beasley et al. (1998). Based on sampling of approximately 46 wells, Beasley et al. (1998) showed that Tc-99 was present in groundwater of the Snake River Plain Aquifer (SRPA) at relatively low concentrations (<60 pCi/L) over a large area extending south from the Idaho Nuclear Technology and Engineering Center (INTEC). The dilute plume containing detectable Tc-99 concentrations in groundwater was shown to extend south from INTEC to the area of Big Southern Butte, located just outside the Idaho National Engineering and Environmental Laboratory (INEEL) southern boundary. The Tc-99 plume was found to be similar in shape and size to the known tritium plume south of INTEC. The highest Tc-99 concentration observed at that time was 55.6 pCi/L in perched water well USGS-50. Based on the geometry of the observed Tc-99 plume, Beasley et al. (1998) estimated that a total of approximately 15 Ci of Tc-99 were present in the SRPA and that the Tc-99 plume occupied an area of approximately 53 mi^2. Although no disposal records for Tc-99 are known to exist, Beasley et al. (1998) attributed the presence of Tc-99 in the SRPA to its disposal at the former INTEC injection well (Note: Wastewater was injected into both the aquifer and vadose zone.), which was used from 1953 until 1986 for disposal of low-level radioactive wastewater (service waste) from INTEC operations.

The OU 3-13 Remedial Investigation and Baseline Risk Assessment (RI/BRA) (DOE-ID 1997) and the OU 3-13 Record of Decision (ROD) (DOE-ID 1999) both discussed the occurrence of Tc-99 in groundwater at and downgradient of INTEC. It is known that the high-level liquid waste (HLLW) tanks at the INTEC tank farm have stored wastes that contained Tc-99. The RI/BRA estimated that the CPP-31 liquid release that occurred in November 1972 accounted for 95.9% of the Tc-99 mass released to the aquifer. The CPP-31 release site is located near the HLLW underground tanks at the INTEC tank farm.

Tc-99 concentrations in groundwater in 2001 and 2003 were presented in the INTEC Annual Well Monitoring Reports (DOE-ID 2002a, 2003a). Figure 1 shows the locations of monitor wells at and near INTEC, and Figure 2 shows Tc-99 concentrations in groundwater observed in 2003.

Prior to 2003, groundwater samples had not exceeded the Tc-99 drinking water MCL of 900 pCi/L. The maximum Tc-99 concentration observed in the aquifer prior to 2003 was 518 pCi/L reported in a sample collected December 1994 from aquifer monitor MW-18 (DOE-ID 2003b). Monitor well MW-18 is located in the central part of INTEC and southeast of the INTEC tank farm (Figure 1). During groundwater monitoring in **2001,** the highest observed Tc-99 concentration was in aquifer monitor well USGS-52 located along the eastern INTEC fenceline (Figure 1); this well contained 322 pCi/L Tc-99.

During routine groundwater monitoring in May 2003, a higher concentration of Tc-99 than had been observed previously was reported in new INTEC TF-Aquifer monitor well (Figure 1). This monitor well is located within the INTEC security fence and approximately 300 ft outside the tank farm northern fenceline. The well is screened from 443 to 483 A with a pump intake depth at 474 ft below land surface. Borehole logging and well completion information for the Tank Farm Well Set, including the TF-Aquifer well, are included in Appendix A. The laboratory reported a Tc-99 concentration of 2,220 pCi/L for a groundwater sample collected May 13,2003, from this well. This result was the first to exceed the Tc-99 groundwater quality standard of 900 pCi/L. Because the tank farm aquifer well is a new well that was first sampled in May 2003, no previous groundwater quality results are available for this well. Concentrations of tritium (3700 5178 pCi/L), Sr-90 (7.61 51.05 pCi/L), and 1-129 (0.12 50.03 pCi/L) in the tank farm aquifer well were all below the respective groundwater quality standards for the May 2003 groundwater sample.

To confirm the May 2003 Tc-99 results, the tank farm aquifer well was resampled by Bechtel BWXT Idaho LLC (BBWI) on August 11,2003, with duplicate samples from the well sent to two separate laboratories. In addition, the USGS co-sampled the well with BBWI on that date. The USGS sent duplicate samples from the well to two different laboratories, for a total of four laboratories analyzing groundwater samples from the tank farm aquifer well. The results for the initial sampling on May 13,2003, as well as the August 11,2003, re-sampling event, are summarized in Table 1. Tc-99 concentrations reported in the groundwater samples collected from the tank farm aquifer well ranged from 2,000 to 2,840 pCi/L. Therefore, it has been confirmed that the groundwater from the tank farm aquifer well contains Tc-99 at concentrations higher than observed previously in groundwater at or near INTEC.

These observed values for Tc-99 activity in the aquifer significantly exceed the predicted activities from both the original OU 3-13 RI/BRA (DOE-ID 1997) and more recent updated WAG 3, Group 5 modeling results (DOE-ID 2003c). The original RI/BRA predicted a peak concentration of approximately 200 pCi/L in the year 2000, and the updated Group 5 modeling results predicted a peak concentration of approximately 20 pCi/L. (Note: The same vadose zone source term and flux to the aquifer were used for both modeling studies; however, the more recent Group 5 study used an updated conceptual model for the aquifer. Based on new data obtained since completion of the RI/BRA, the updated Group 5 numerical model utilized an aquifer thickness of 200 m versus 76 m used for RI/BRA. The increased thickness and subsequent dilution are the primary reasons for the decrease in predicted Tc-99 concentrations in the updated numerical model.)

In accordance with the Safe Drinking Water Act (SDWA), the INTEC drinking water system has been routinely sampled for gross alpha and gross beta radiation. The most recent sampling event occurred on June 10,2003, and the results indicate gross beta activity of 1.7 pCi/L. If significant Tc-99 activity

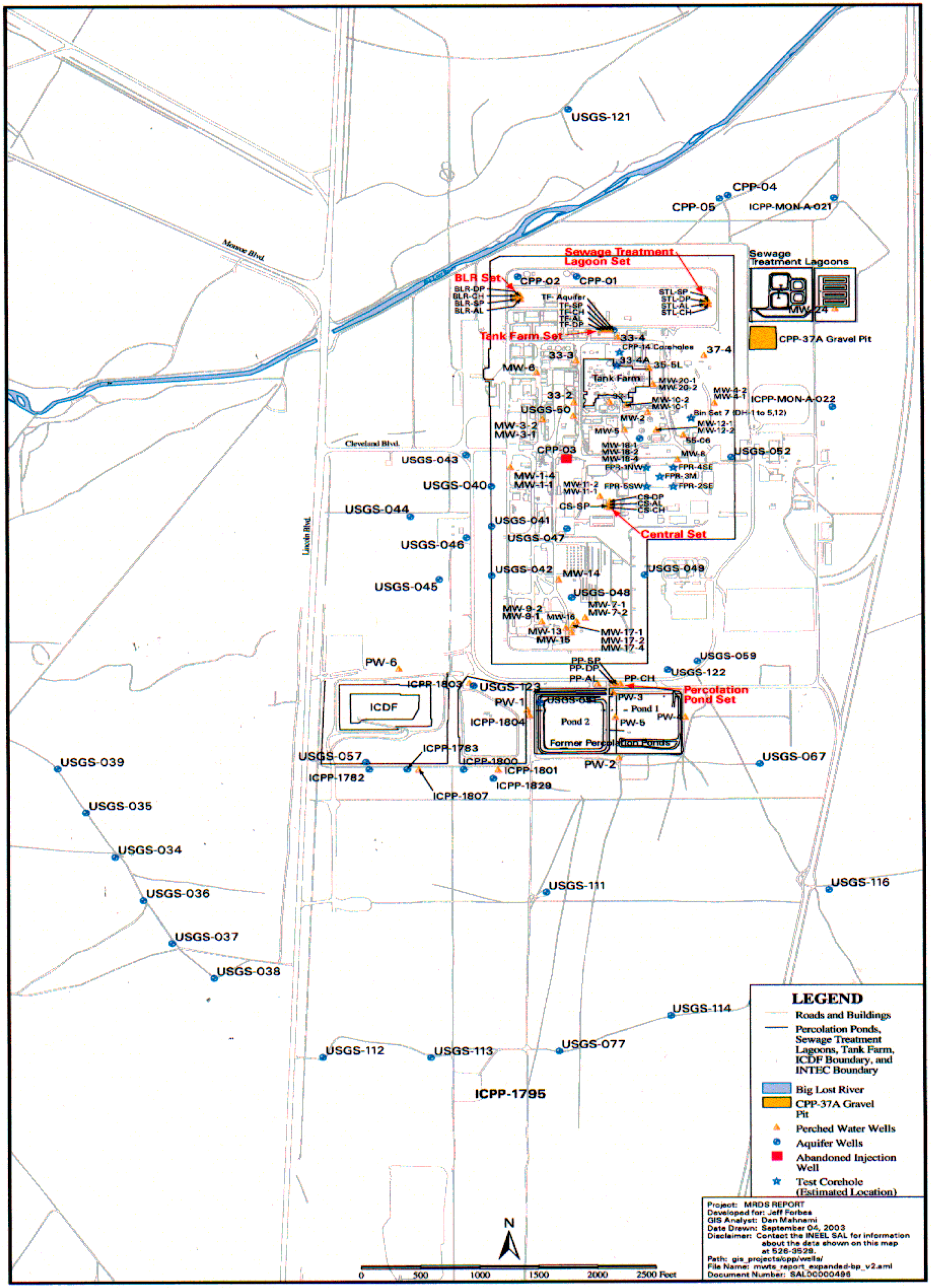

Figure 1. Idaho Nuclear Technology and Engineering Center monitoring wells.

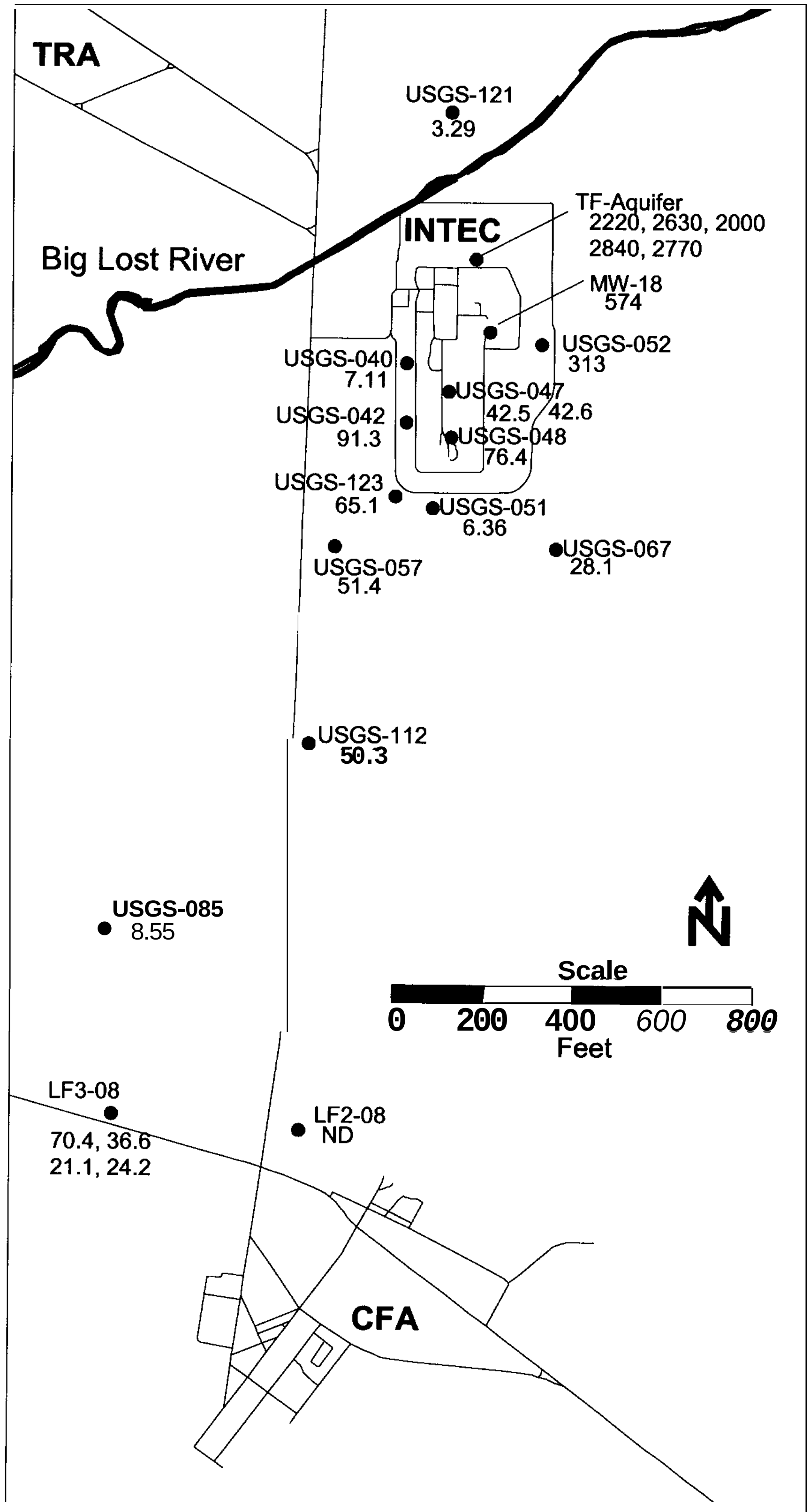

Figure 2. Distribution of Tc-99 in **the SFWA** in 2003 (concentrations in pCi/L, taken from [DOE-ID 2003a]).

Table 1. Summary of Tc-99 concentrations in groundwater at tank farm aquifer well.

Sample Date	Sample Collected by	Laboratory	Tc-99 Concentration (pCi/L)	Uncertainty (pCi/L, ±1 sigma)	MDA (pCi/L)
05/13/03	BBWI	GEL	2,220	37.7	16.0
05/13/03	BBWI	GEL	2,110[a]	32.4	6.75
08/11/03	BBWI	GEL	2,840	43.4	8.18
08/11/03	BBWI	GEL	2,770[a]	42.2	7.94
08/11/03	BBWI	STL	2,630	260	3.0
08/11/03	BBWI	STL	2,000[a]	200	1.0
08/11/03	USGS	RESL	2,340	10	NR
			2,290[b]	110	NR
08/11/03	USGS	ISU	2,417	4.3	NR

a. Field duplicate.
b. Lab duplicate (repeat analysis).
Abbreviations:
BBWI = Bechtel BWXT Idaho, LLC
GEL = General Engineering Laboratories, Charleston, South Carolina
ISU = Idaho State University
MDA = minimum detectable activity
NR = not reported or unknown
RESL = Radiological and Environmental Sciences Laboratory, INEEL
STL = Severn-Trent Laboratories, St. Louis, Missouri
USGS = U.S. Geological Survey

were present in the INTEC drinking water system, elevated gross beta levels would be expected. Conversely, the low gross beta activities demonstrate the absence of significant concentrations of beta-emitting radionuclides, including Tc-99. The INTEC drinking water system is currently in compliance with all MCLs dictated by the SDWA.

In the past, routine monitoring of the INTEC drinking water supply system has not included sampling and analysis for Tc-99. However, as a result of the **2003** results for the tank farm aquifer well, a water sample was collected from the INTEC drinking water distribution system on August **18,2003.** Tc-99 was not detected in this water sample **(<1.5** pCi/L). The INTEC drinking water distribution system draws its water from the two potable water supply wells located north of the INTEC fenceline (CPP-04 and CPP-05; see Figure **1).**

1.2 Project Objectives and Approach

A phased approach with an aggressive schedule for completion will be implemented to address the Tc-99 aquifer contamination at INTEC. **The** initial Phase **I** work is being conducted to provide an evaluation of the extent of the Tc-99 contamination in the aquifer and the potential source(s) of the contamination. Due to a desire to perform the Phase **I** work activities in an expedient manner, this Work Plan has been prepared as a supplement to existing WAG **3,** Group 4, documents, which have already been reviewed and approved by the Agencies. The follow-on activities to evaluate the well and the Tc-99 groundwater contamination will be performed in accordance with the ***Long-Term Monitoring Plan for Operable Unit 3-13, Group 4 Perched Water*** (DOE-ID **2000).** Specifically, Section **8.3,** Unusual Occurrences, identifies the process for handling ***"...situations that are unforeseen, unanticipated, or unexpected...."*** This section also states: ***"For significant unusual occurrences, take appropriate action, which may include increasing sampling (in network, not just individual well) and/or monitoring***

***frequency, or reviewing the ROD for implementation of a remedial action (for example, curtailing steam condensate discharges to the subsurface).*"** This Work Plan Supplement is provided to the Agencies to describe the activities to be performed to further assess this unusual occurrence.

The initial objective of this Work Plan is to determine if contamination observed in TF-Aquifer is the result of cross-contamination during drilling or if the contamination is the result of transport through the vadose zone. The primary difference between contamination resulting from these two potential mechanisms for transport to the aquifer is the extent of contamination that would likely result. If the contamination resulted from cross-contamination, the extent of contamination should be localized to the well itself. If the contamination migrated through the vadose zone, the extent of contamination in the aquifer could be greater and possibly not present in the well bore or basalt core obtained from the well.

1.3 Scope of Work

1.3.1 Phase I

The Phase I scope of work described in this Work Plan includes the following items:

- Groundwater elevation monitoring and the collection of groundwater samples from TF-Aquifer monthly from October 2003 through January 2004 for Tc-99, Sr-90, I-129, and H-3 with additional analyses of the initial October sample to include a broad suite of analytes including radionuclides, mercury, volatile organics, and semivolatile organics

- Collection of groundwater samples from the Tank Farm Well Set suction lysimeters and perched water piezometers in October 2003 for Tc-99, Sr-90, I- 129, and H-3

- Sampling of the production wells CPP-I and CPP-2 in October and December for Tc-99, Sr-90, 1-129, and H-3

- Capture zone analysis of the INTEC production wells (CPP-1 and CPP-2) and potable water wells (CPP-4 and CPP-5)

- Geophysical and fluid logging of TF-Aquifer and adjacent tank farm aquifer nested well set (neutron logging only)

- Well development and performance of a pump test on TF-Aquifer with the collection of samples for Tc-99 during the development and pump test

- Radiological screening of borehole core material from TF-Aquifer and sampling of core for Tc-99 analysis

- Evaluation of TF-Aquifer construction details for evidence of cross-contamination

- Evaluation of potential Tc-99 source terms

- Evaluation of vadose zone stratigraphy in the vicinity of TF-Aquifer, MW-18, and USGS-52, all of which exhibit elevated Tc-99 activities.

1.3.2 Phase II

Phase II activities will be implemented based upon the results of Phase 1. The objective of the Phase II activities, as stated earlier, will be to evaluate the potential sources of Tc-99 contamination identified in Phase I. Field investigations for Phase II will most likely be the installation of soil borings and/or wells to evaluate the extent of contamination associated with the potential sources and extent of contamination in the aquifer beneath the northern portion of INTEC in the vicinity of well TF-Aquifer. It is anticipated that the Phase II activities developed, based on the results of Phase I, will be incorporated in a revision of the WAG **3,** OU **3-14** Remedial **Investigation/Feasibility** Study Work Plan.

2. INVESTIGATION TASKS

The two major categories of investigation tasks are field activities and data evaluation.

2.1 Field Activities

Field activities will include sampling and analysis, geophysical and fluid logging, and well development and pump testing.

2.1.1 Sampling and Analysis

2.1.1.1 Groundwater. Monthly groundwater sampling of TF-Aquifer will be performed from October **2003** through January **2004.** Additional samples will be taken from the Tank Farm Well Set suction lysimeters and perched water monitoring wells in October **2003,** from the INTEC production wells CPP-1 and CPP-2 in October and December **2003,** and from MW-18 aquifer well in December **2003.** Samples will be analyzed routinely for Tc-99, Sr-90,I-129, and **H-3.** A broader suite of analytes will be analyzed during the October **2003** sampling from the TF-Aquifer well. Table **2** lists the sampling dates, locations, and analyses to be performed.

In addition to the monthly groundwater sampling, groundwater sampling will also be performed during the development and pump testing of TF-Aquifer, described in Section **2.1.3** below. Samples will be collected at the rate of one sample per hour during these activities, with as many as 10 samples to be collected during each activity. Groundwater samples collected during the well development and pump test will be analyzed for Tc-99, Sr-90, and **H-3.**

2.1.1.2 TF-Aquifer Core Sampling. Basalt and interbed core was collected during the installation of the Tank Farm Well Set. This core has been archived at the USGS core library located at the Central Facilities Area at the INEEL. Core from the Tank Farm Well Set corehole will be retrieved for sampling purposes. To determine sampling locations, the core will be screened at the core library with a beta/gamma field screening instrument to identify any locations of increased or peak activities in the core for sampling and analysis. Based on the results of the field screening, a minimum of three and a maximum of 10 samples will be taken of the core for analysis. The selected core samples will be analyzed for Tc-99, Sr-90, gross alpha/beta, and gamma spectroscopy.

Table 2. Tc-99 evaluation groundwater sampling schedule.

Sampling Date	Sampling Location	Type Location	Analyses[a]
October 2003	TF-Aquifer	Aquifer monitoring well	Mercury, volatile organic compounds, semivolatile organic compounds, Tc-99, Sr-90, I-129, H-3, gross alpha/beta, gamma spectroscopy, Pu-isotopes, Pu-241, U-isotopes, Np-237, Ra-226, Ra-228
	ICPP-SCI-P-227, -228, -229, -252	Tank Farm Well Set perched water monitoring wells	Tc-99, Sr-90, I-129, H-3
	ICPP-SCI-P-227, -228, -229	Tank Farm Well Set suction lysimeters	Tc-99, Sr-90, I-129, H-3
	CPP-1 and CPP-2	Production wells	Tc-99, Sr-90, I-129, H-3
November 2003	TF-Aquifer	Aquifer monitoring well	Tc-99, Sr-90, I-129, H-3
December 2003	TF-Aquifer	Aquifer monitoring well	Tc-99, Sr-90, I-129, H-3
	CPP-1 and CPP-2	Production wells	Tc-99, Sr-90, I-129, H-3
	MW-18 Aquifer	Aquifer monitoring well	Tc-99, Sr-90, I-129, H-3
January 2004	TF-Aquifer	Aquifer monitoring well	Tc-99, Sr-90, I-129, H-3

a. Analyte suite may be limited depending on volume of sample available, particularly from the Tank Farm Well Set perched water monitoring wells and suction lysimeters.

2.1.2 Geophysical and Fluid Logging

2.1.2.1 Neutron Logging. Neutron logging of the TF-Aquifer borehole and adjacent Tank Farm Well Set perched water wells will be performed to evaluate the presence of moisture and/or perched water outside of the casing of these wells. The INEEL field office of the USGS will perform the neutron logging of these wells.

2.1.2.2 Colloidal Borescope. The measurement of groundwater velocity (speed and direction) is useful in contributing to the overall evaluation of contaminant extent and migration. The ability to accurately measure groundwater flow velocity has been the goal of several research and field activities over the past years, particularly with the increased emphasis on subsurface transport processes at hazardous waste sites. Conventional methods have relied on estimates of hydraulic conductivity and calculations based on Darcy's law to estimate seepage velocity in the aquifer. Based on theoretical predictions and experimental evidence, researchers have explored methods to measure flow velocities in wells. Examples of these attempts included borehole dilution methods, the KV Heat-Pulsing Flow Meter (thermister technology), and the laser Doppler velocimeters (Kearl 1996).

To measure groundwater flow velocities, this project plans to use the colloidal borescope, developed by Oak Ridge National Laboratory. Unlike the above-mentioned methods, the colloidal borescope provides a direct measurement of the water velocity in a well by directly observing the movement of naturally occurring particles (colloids) that exist in all groundwater. The colloidal borescope consists of a charged-couple device camera, an electronic compass for orientation, optical magnification lens, illumination source, and stainless steel housing (measuring 24 in. long with a diameter of 1.7 in.). Particles are magnified 140 times and observed at the surface on a video monitor. Colloidal movement in the groundwater is monitored using a video frame grabber that is capable of analyzing video images from the colloidal borescope every few seconds. A software program analyzes the digitized video images; calculates the particle number, size, flow direction, and flow rate; and records the data on computer files (Kearl 1994).

The colloidal borescope will be deployed at several depths within the well's screened interval to obtain a broad range of groundwater velocity information. The number of zones from which data are collected will be dependent on specific downhole conditions. Up to a 30-minute delay may be required between the tool placement and the start of data collection due to the time it will take for the screened interval to return to a state of equilibration (placement of the tool in the screened interval will disturb the natural groundwater flow). In addition, 60 or more minutes may be required for data collection at each depth to ensure that the natural osculating groundwater speed and direction changes are recorded (Shanklin 1996).

2.1.3 Well Development and Pump Testing

Well development shall consist of over-pumping of the well until the discharge water appears to be visibly clear. The existing groundwater sampling pump will be removed and a high-capacity pump will be installed prior to development. Because of the well design and screen diameter, pump selection is constrained and it is anticipated that a pumping rate of as much as 75 gpm may be achievable to support the well development. Well development will be limited to approximately 1 day duration prior to conducting the pump test, generating an approximate maximum volume of 5000 gal development water.

A conventional step-drawdown test will be performed on well TF-Aquifer after the planned well development activity. The primary intent for conducting a step-drawdown test is to observe Tc-99 concentrations over both time and during increasing pumping rates. As a secondary effort, the step-drawdown test can be used to determine the following:

- The specific capacity of the well at various discharge rates
- A ratio (Lp) denoting the percentage of the total head loss attributable to laminar flow
- Transmissivity
- Hydraulic conductivity
- Well efficiency information.

The plan is to conduct a five-step step-drawdown test. The first step should begin with a flow rate equal to approximately 25% of the expected maximum pumping rate or the desired yield and progress to higher rates in discrete steps until the water level fails to equilibrate during the step period. Planned step-test durations are 1 hour. The initial step-test design is listed in Table 3. Specific aquifer conditions and pump performance may require alterations to the planned step-test design.

Water level data will be collected using an installed transducer with an attached datalogger. Water level data will continue to be collected after the final step is completed and the pump is shut off (recovery period) until the water level nears full recovery.

Groundwater samples will be collected for analysis during the well development and pump test as described in Section 2.1.1.1.

Table 3. Planned step-drawdowntest design.

Step	Pumping Rate (gpm)	Duration (min)	Start Time	End Time	Start Gallons	End Gallons	Gallons Produced
1	20	**60**	0	60	**0**	1,200	1,200
2	**35**	**60**	**60**	120	1,200	**3,300**	2,100
3	**50**	60	120	180	**3,300**	**6,300**	**3,000**
4	**65**	**60**	180	240	**6,300**	10,200	3,900
5	80	**60**	240	300	10,200	15,000	4,800
	Total Min	**300**					
	Total Hr	**5**				Total Gal	15,000

All generated purge water from both well development and the pump test will be containerized and treated as Comprehensive Environmental Response, Compensation and Liability Act waste and disposed of at the INEEL CERCLA Disposal Facility evaporation ponds.

2.2 Data Evaluation Tasks

2.2.1 Well Construction Evaluation

An evaluation of the data and field notes from the drilling of TF-Aquifer will be conducted to determine if there is a potential for cross-contamination during construction. The review will include all well construction field notes, downhole video and gamma logs, and tensiometers data for indications of perched water or contaminated soil at the Tank Farm Well Set. This information will be used to determine if the well may have been drilled through contaminated zones and to ensure that appropriate measures were taken to prevent cross-contamination to the aquifer.

2.2.2 Vadoze Zone Stratigraphy

A review of the vadose zone stratigraphy will be performed to evaluate potential directions of perched water migration laterally in the vadose zone in the vicinity of the Tank Farm Well Set and TF-Aquifer.

2.2.3 Capture Zone Analysis

Capture zone analysis of the INTEC production wells (CPP-1 and CPP-2) and potable water wells (CPP-4 and CPP-5) will be performed to determine if these wells capture water beneath the tank farm. The analysis will utilize the MODFLOW (MacDonald and Harbaugh 1988) and MODPATH (Pollock 1994) computer software. MODFLOW is a three-dimensional groundwater flow simulator produced by the USGS and MODPATH is particle tracking companion software for MODFLOW. The MODFLOW and MODPATH software will be used to simulate steady-state and transient flow paths near the tank farm and the INTEC production wells.

The simulation domain will be 1200 m x 1200 m centered approximately on the CPP-1 production well. The simulations will be parameterized using hydraulic conductivity and porosity from the Group ***5*** aquifer model (DOE-ID 2003c). The Group 5 aquifer model used hydraulic conductivity estimated from well pump tests and this data set will be modified with the addition of the tank farm aquifer well pumping test result and interpolated onto the refined capture zone simulation grid.

The flow path analysis will include simulations of both transient and steady-state pumping rates for the CPP-1, -2, -4, and -5 production wells, assuming the following scenarios:

1. Base case with large-scale ambient aquifer gradient and no surface water recharge

2. Base case with surface water recharge originating from the northern INTEC, which includes precipitation, water system leaks, landscape irrigation, steam condensate, CPP-603 basins, and sewage treatment ponds (estimated from Table 1-8 of the OU 3-13 RI/BRA, Appendix F [DOE-ID 19971)

3. Surface recharge noted in Item 2 and the long-term average Big Lost River recharge presented in the OU 3-13 RI/BRA (DOE-ID 1997).

The ambient hydraulic gradient will be that predicted by the Group 5 aquifer model. The well production rates will be estimated from current INTEC well operation logs.

2.2.4 Tc-99 Source Term Evaluation

The source of Tc-99 in groundwater at the tank farm aquifer well is not currently known with certainty. Therefore, an evaluation of the potential Tc-99 sources at INTEC will be performed. Because of its low activity compared to other fission products present in SNF, few data are available regarding Tc-99 sources at INTEC. It is known that significant quantities of Tc-99 (many curies) are present in both the HLLW and the calcined wastes stored at INTEC, and reasonably reliable estimates exist of the Tc-99 inventories present in each of these materials. However, no records exist to document Tc-99 concentrations in the service waste that was previously disposed of in the former INTEC injection well. The existence of a dilute plume of Tc-99 in the SRPA downgradient of INTEC suggests that the former injection well could constitute a source of Tc-99 to the aquifer.

The Tc-99 source investigation will include a review of information regarding the total Tc-99 inventory present in the SNF historically processed at INTEC (formerly the Idaho Chemical Processing Plant), as well as estimates of the total Tc-99 inventories in calcined waste and the remaining HLLW. The total activity of Tc-99 sent to the former injection well during its operation will also be estimated. Finally, based on the most current information, the Tc-99 activity and volume of the most significant known historical liquid waste leaks at the tank farm will be calculated, and these values used to revise the estimates of the total curies of Tc-99 released at the tank farm.

Another related task will be to compare the Tc-99/tritium ratio in the HLLW (and sodium-bearing waste [SBW]) to that observed in the groundwater at the tank farm aquifer well. When adjusted for the natural radioactive decay of tritium, this ratio should remain relatively constant over time. If the Tc-99 present in the aquifer were derived from the tank farm, we would expect the Tc-99/tritium ratio in the groundwater to resemble that in the HLLW or SBW. The Tc-99/I-129 ratio and the Tc-99/nitrate ratio in HLLW and SBW will also be calculated and compared with those in groundwater. Similar estimates will be made for the stored calcined waste and for the service waste disposed of in the former injection well.

3. REPORTING

A summary report documenting the results of activities described in this Work Plan and containing recommendations for further Phase II actions will be submitted for Agency review by April 29,2004.

4. SAMPLING PROCEDURES

The sampling and monitoring procedures for groundwater monitoring described in this Work Plan are described in Sections 4.4 and 4.5 of the ***Field Sampling Plan for Operable Unit 3-13, Group 4, Perched Water Well Installation*** (DOE-ID 2003d).

5. SAMPLE CONTROL

Sample control activities, including sample identification, sample handling, and radiological screening of all soil and groundwater samples collected under this Supplemental Work Plan will be performed as specified in Section 5 of the ***Field Sampling Plan for Operable Unit 3-13, Group 4, Perched Water Well Installation*** (DOE-ID 2003d).

6. QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance/quality control activities and requirements, including project quality objectives, field data reduction, data validation, and quality assurance objectives for measurements for all soil and groundwater samples collected under this Supplemental Work Plan, will be performed as specified in Section 6 of the ***Field Sampling Plan for Operable Unit 3-13, Group 4, Perched Water Well Installation*** (DOE-ID 2003d).

7. PROJECT ORGANIZATION

The project organization and responsibilities for work performed under this Supplemental Work Plan are specified in Section 6 of the ***Field Sampling Plan for Operable Unit 3-13, Group 4, Perched Water Well Installation*** (DOE-ID 2003d).

8. WASTE MANAGEMENT

Waste management for waste generated during activities performed under this Supplemental Work Plan will be performed as specified in the ***Waste Management Plan for Operable Unit 3-13, Group 4 Perched Water*** (DOE-ID 2003e). All waste water generated during the activities described in this Work Plan, including waste water generated from well sampling, well development, and the pump test, will be containerized and treated as Comprehensive Environmental Response, Compensation and Liability Act waste and disposed of at the INEEL CERCLA Disposal Facility evaporation ponds.

9. HEALTH AND SAFETY

A project-specific Health and Safety Plan (HASP) (DOE-ID 2002b) has been prepared to define the health and safety requirements for this project. This HASP establishes the procedures and requirements used to minimize health and safety risks to persons working on the OU 3-13, SRPA project. The HASP meets the requirements of the Occupational Safety and Health Administration (OSHA) Standard, 29 CFR 1910.120 and 29 CFR 1926.65, "Hazardous Waste Operations and Emergency Response." The document's preparation is consistent with information found in the following reference:

- National Institute of Occupational Safety and Health (NIOSH)/OSHA/United States Coast Guard (USCG)/U.S. Environmental Protection Agency (EPA) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities (NIOSH 1985).

The HASP governs all work support of the OU 3-13 that is performed by the INEEL personnel, INEEL subcontractors, or employees of other companies. Persons not normally assigned to work at the site, such as representatives of the Department of Energy, Department of Energy Idaho Operations Office, the State of Idaho, OSHA, and EPA, are considered occasional workers as stated in 29 CFR 1910.120 and 29 CFR 1926.65.

10. DOCUMENT MANAGEMENT

Documentation of field activities, including sample labels, log books, and photographs, will be generated and maintained as specified in Section 10 of the ***Field Sampling Plan for Operable Unit 3-13, Group 4, Perched Water Well Installation*** (DOE-ID 2003d).

11. REFERENCES

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DOE-ID, 2003d, *Field Sampling Plan for Operable Unit **3-13,** Group **4,** Perched Water Well Installation*, DOEAD-10745, Rev. 2, **U.S.** Department of Energy Idaho Operations Office, February 2003.

DOE-ID, 2003e, *Waste Management Plan for Operable Unit **3-13,** Group **4** Perched Water,* DOE/ID-10749, Rev. 2, **U.S.** Department of Energy Idaho Operations Office, September 2003.

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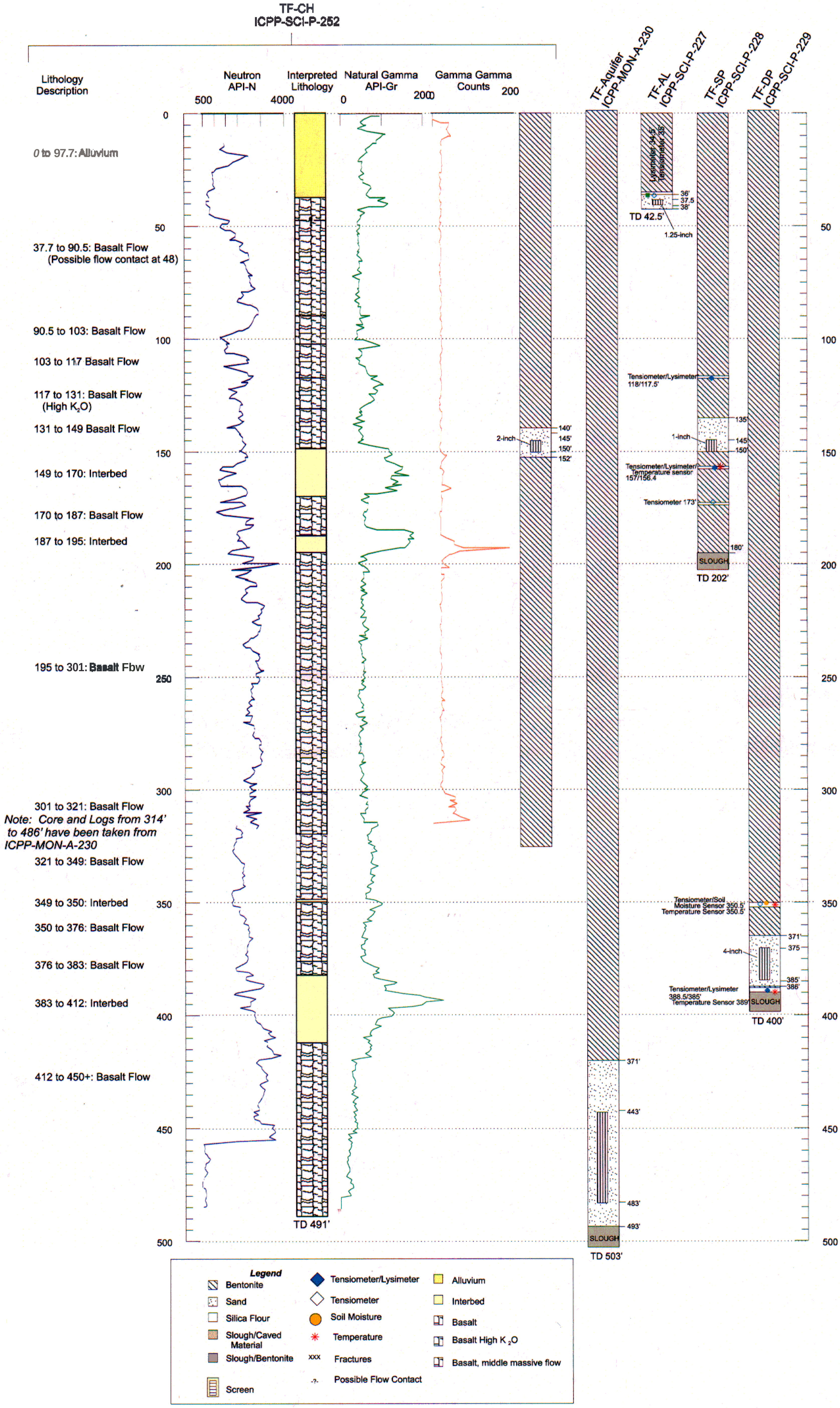
Appendix A

Well Completion Diagrams

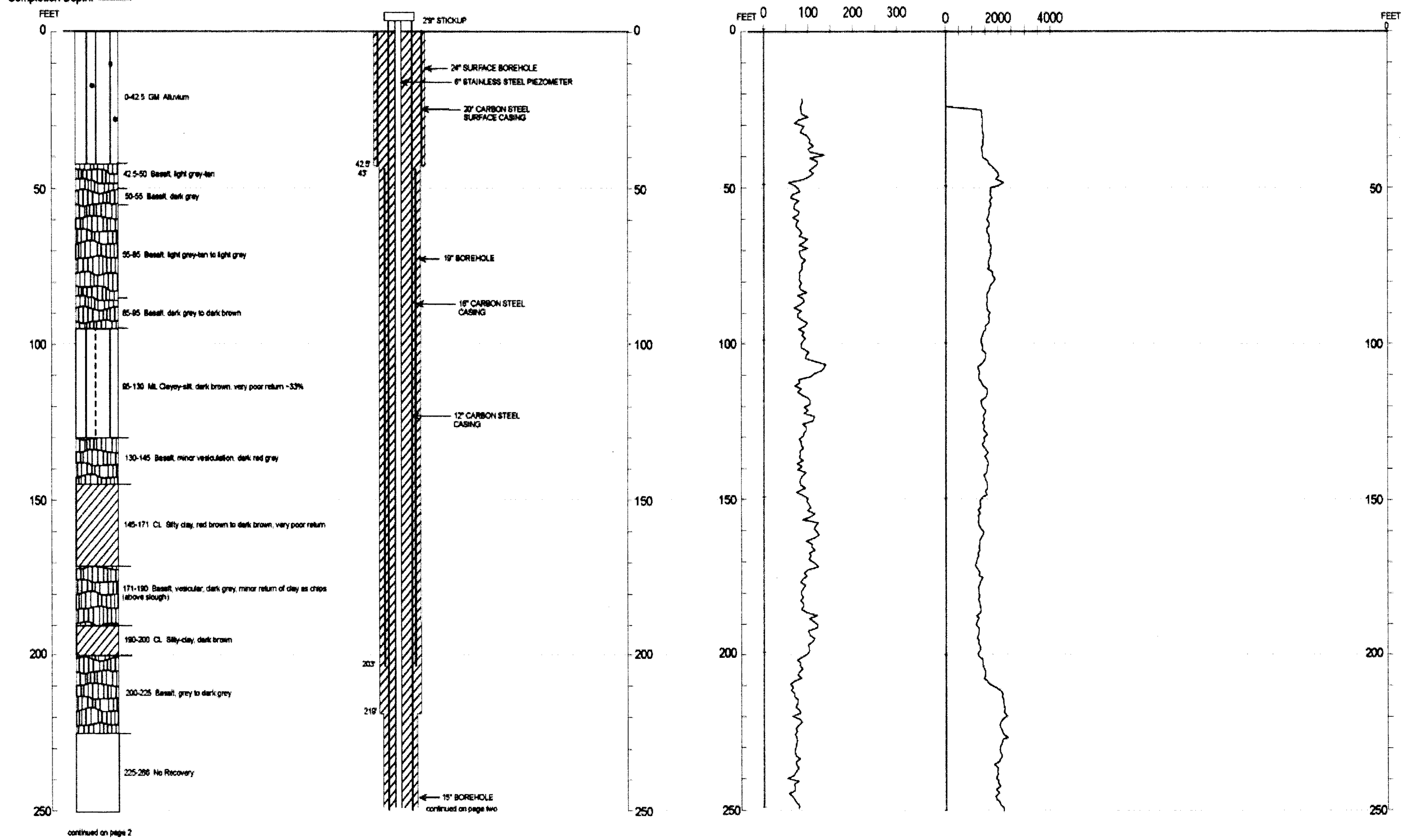
Tank Farm Set



WELL NAME: TF-Aquifer (ICPP-MON-A-230)
Facility: INTEC
Well Type: Monitoring-piezometer
Well Status: Active
Year Drilled: 2001
Total Depth: 503'
Start Date: 2/27/01
End Date: 3/13/01
Completion Depth: 483'

Driller: Dynatec/ Rosario/ Jensen
Geologist: Johannesen/ Hall/Whitmore
Drill Method: Air rotary
Drill Fluid: Air

Todays Date: 7/16/01
Water Level:
Water Level Date:
Water Level Access:



TF-Aquifer

WELL NAME: (ICPP-MON-A-230 PG 2)

Facility: INTEC

Well Type: Monitoring-piezometer

Well Status: Active

Year Drilled: 2001

Total Depth: 503'

Start Date: 2/27/01

End Date: 3/13/01

Completion Depth: 483'